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THE IMPACT OF THE EL NINO OF 1983 ON GOAT
PRODUCTION IN PIURA: A FOLLOWUP STUDY

by

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ABSTRACT

Following a year-long study of the Northern Peruvian Goat production situation during 1982 (published in Technical Report 33, SR-CRSP), the author was able to return to the region in July of 1983 for a short visit to witness the effects of the Nino phenomenon which took place between December 1982 and June of 1983. The effect of torrential rains upon the dry coastal plains was dramatic with an abundance of vegetation being produced where previously there were only a few trees and dormant shrubs. A general description of the biomass is given for each of four ecological regions discussed in the companion report. The impact of the phenomenon upon goat production is also discussed. An overview of changing producer and marketing strategies is given, and some of the impacts upon local consumers as well.

In general, the criollo goat fared well, with most goats in the area bearing twins, although mortality was high among kids and was considered to be the biggest problem at the time. Mention is also made of the possibility for cattle producers, both private operators and cooperatives to compete with the goat producers for rights to use (and exclude others from using) the abundant pasturage. Finally, some observations are made concerning arguments which tended to blame goats for destroying the vegetation. The author suggests that the Nino phenomenon of 1983 was a demonstration of the region's climatic variability and that perhaps the previous absence of vegetation was not due as much to overgrazing on the part of goats but rather a consequence of drought. Indeed, the goat and peasant producer seem to be ideally suited to take advantage of this tremendous variability.

ACKNOWLEDGEMENTS

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THE IMPACT OF THE EL NINO OF 1983 ON GOAT RAISING
IN PIURA: A FOLLOW-UP STUDY

INTRODUCTION

Arid zones are notorious for drastic variations in annual precipitation. It is often claimed that the rainfall average in an arid environment is meaningless because of the considerable fluctuations between years and the high standard deviation of the calculated mean (sometimes exceeding 100%). In the dry coastal plains of Piura, in northwestern Peru, the climatic fluctuations are even more dramatic. Here, on top of the yearly variations similar to other dry habitats, approximately once every decade, the oceanographic/climatological phenomenon known as El Nino generates storms and rains that can surpass the annual average many times over; 1983 was such a year. Overall, during the first six months of 1983, the rains were approximately 10 times greater than the longterm annual average. The city of Piura, where annual average rainfall for the last 24 years has been 40.95 mm (s.d = 41.0)¹, received 2225.2 mm from January to June 1983. In Chulucanas (80 km east of Piura, and closer to the mountains) 3145.6 mm were recorded during January to April, whereas the longterm average there is 258.6 mm (s.d = 211.8, 17 years of observations)¹.

¹Calculated from data obtained from SENAHMI (The Peruvian National Meteorological Service) in Piura and Lima.

What makes the case of the 1983 El Nino in Piura even more interesting, at least from the point of view of natural resource utilization and livestock production, is the fact that the preceding year was one of severe drought. During 1982, Piura received only 5.4 mm of rainfall (17% of the annual average) and Chulucanas only 46.9 mm (18%).

During 1982, I conducted a study on goat production in Piura. Since most of my fieldwork took place during the drought, it was only logical to study a very dry year followed by a very abundant year in order to compare the impact of each upon goat production. Being able to observe the two extremes of a system over a relatively short period of time is a rare opportunity. However, without additional financial support from the Small Ruminant CRSP Sociology Project (University of Missouri-Columbia) and encouragement from its Director Dr. Michael Nolan, this followup would not have materialized. Keith Jamtgaard and Benjamin Quijandria of SR-CRSP/Peru were also instrumental in making this re-study possible.

This report gives a brief account of the impact of the El Nino on goat production and goat producers in Piura. An inclusive description of the production system itself can be found in Los Pobladores de los Despoblados: Goat Herders in Piura, Peru (Perevolotsky Small Ruminant Technical Report #33) and in other publications of the SR-CRSP Goat Project. This report is based on three weeks' research in Peru during July 1983. The data presented here were gathered in conversations with herders of the despoblados (scrubland plains) of Piura and Lambayeque. Most of these men were former informants and acquaintances. Also, an effort was made to observe the livestock in the corral or in the field

in order to verify herders' verbal reports. Most of the goat herders interviewed during this trip live along the following routes: Piura-Sullana-Quebrada Seman; Piura-middle Piura Valley--Los Ejidos, Curumuy, Santa Ana; Piura-San Lorenzo-Las Lomas-El Progreso; The Lower Piura Valley; and Piura-Chulucanas-Pabor-Naupe.

Poor transport conditions and limited accessibility due to torrential rains and subsequent floodings were a serious problem in Piura during this trip. This prevented me from visiting the despoblados of Mallares (Sullana)--a region of high goat production and other off-road operations. To complete the overall picture, interviews were conducted with officials of the Ministry of Agriculture, the Meteorological Service (SENAMHI), market and slaughterhouse authorities, and with university researchers in Piura, Sullana, and Lima.

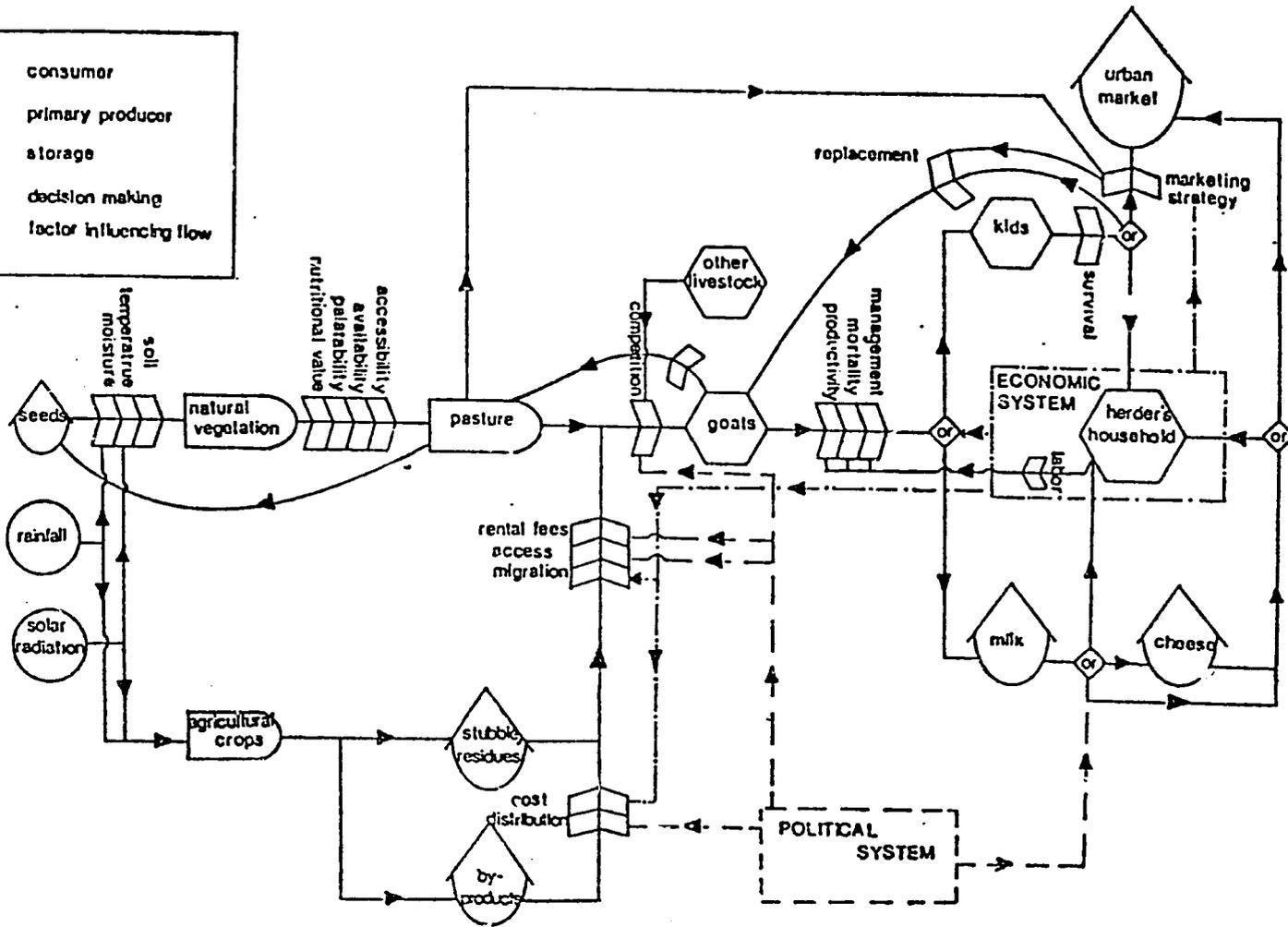
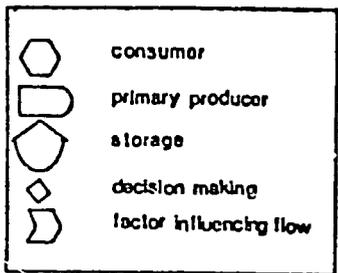
OVERVIEW OF GOAT PRODUCTION

Figure 1 presents a schematic overview of the goat production system in Piura. Only the more important and determinant factors are included. The wide arrows represent factors affecting the flow of material or energy from one component ("hexagon") of the system to the others. Dark squares stand for a "decision junction" where the producer is actively involved in choosing one of but a few possible alternatives. The numbers refer to sections of this report wherein each numbered factor, component, or decision is briefly discussed.

CLIMATE (1,2)

As noted, El Nino is notorious for causing torrential rains, flooding, and damage along the northern coast of Peru. 1983 seems to be the worst El Nino recorded in this century. The trigger of this

FIGURE 1. A SCHEMATIC OVERVIEW OF GOAT HERDING IN PIURA



phenomenon is the meeting between the normally cold water offshore northern Peru and warm water from the center of the Pacific Ocean. The prevailing theory claims that this occurs because of a temporary weakening in the trade winds, which usually keep the warm water well off the coast. Stable cold air normally prevails along the coast and creates a cover of low clouds over the plains, thus creating a very dry climate or "rainless desert," when the cold air is replaced by warmer, humid, unstable air, then stronger and more frequent rains fall. The coast also then experiences more intense equatorial cyclones.

Table 1 presents the daily and monthly rainfall distribution during January-June of 1983. Table 2 shows the previous occurrences of El Nino in the city of Piura and the annual rainfall related to them. (Compare this to the longterm average of 41 mm calculated from all data available from 1958 to 1982.)

Table 1
 Daily and Monthly Rainfall Distribution in Piura
 (January-June 1983)

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>
1	0	0	0	0.1	0.5	0.6
2	0	0	0.3	0.4	0	0.5
3	0	0	0	31.3	0	2.5
4	33.3	3.4	0	19.0	5.4	40.0
5	66.4	0	0	73.9	7.5	4.3
6	35.6	2.6	0	56.4	4.8	1.2
7	5.0	12.0	0	50.0	2.8	23.7
8	0	0	0	14.5	1.8	112.2
9	4.4	0	65.0	4.3	0.1	1.2
10	0	0	13.1	50.8	0	6.2
11	0	0	20.8	30.7	0	0
12	6.3	0	0	7.6	31.5	0
13	0	104.5	8.8	0.1	8.6	0
14	0.3	12.6	98.9	7.7	91.8	0
15	3.4	0	16.4	6.9	2.3	0
16	0.1	0.1	0.6	69.7	22.4	0
17	2.1	0	7.0	89.0	25.6	0
18	2.1	28.4	17.8	0.9	61.5	0
19	4.6	1.4	1.4	61.3	16.3	0
20	1.1	0.7	0	1.9	3.6	0
21	41.6	0	0	11.7	37.6	0
22	0	0.7	87.8	4.4	0	0
23	0.2	0	8.4	15.0	0	0
24	2.9	0	31.7	0.1	43.0	0
25	67.3	0	1.8	31.7	16.7	0
26	37.0	0	0	8.9	0	0
27	5.0	0	0.3	96.8	1.5	0
28	0	2.0	21.7	3.8	2.0	0
29	5.8	/	0	5.5	0	0
30	0	/	9.9	24.7	13.9	0
31	0	/	0.1	/	0	/
Total	324.5	161.7	428.3	738.9	379.4	192.4

Table 2

El Nino Occurrences During the 20th Century

<u>Year</u>	<u>Annual Rainfall</u>	<u>Month in Which More than 75% of Annual Rainfall Occurred</u>
1983	2225 mm	January-May
1972	156.0	March
1965	85.0	March
1958	139.0	February-March
1953*	?	?
1943	363.1	February-March
1941	208.3	January-April
1939	315.1	February-April
1936	109.6	March-April
1932	?	?
1925*	?	?
1891*	?	?

*Known to be an El Nino year from discharge data of Rio Piura and from historical sources, although reliable meteorological data are absent.

It is important to note that 1983's El Nino was not only significantly stronger than previously recorded events but also exceptionally longer (January-June). The amount, intensity, and duration of rainfall resulted in devastating effects to the urban centers and to some rural areas as well. It also had some interesting effects on the biological ecosystem (see below).

Opinions as to whether the 1983 El Nino will continue in 1984 are divided. Since scientists are still far from understanding the mechanisms behind the phenomenon, it is difficult to make forecasts.

Temperatures have been 4° to 5° C above normal since the rains started in December 1982. Air humidity was also notably higher. Reliable data concerning these parameters are not available yet. However, compared to precipitation, their effect on the natural ecosystem is secondary.

BIOLOGICAL ECOSYSTEM

The magnitude of El Nino-related changes in the biological ecosystem of Piura are hard to imagine. Much information still has to be gathered before a thorough description is possible. However, it does not take an expert to notice that plains which were previously bare are now covered with vegetation. Where before only a few trees and dormant shrubs existed, in July 1983 huge vines and annual or biannual shrubs creating a cover of two or three stories caused the area to resemble the high, dry jungle (ceja de selva) of the eastern slopes of the Andes. Not only is the biomass of the herbaceous vegetation impressive but so is its composition. Botanical or range studies conducted in Piura and

Lambayeque after the rainy years of 1965 and 1975 showed that most of the new vegetation was grass with 8-12% legumes (2, 3).

In 1983 the picture is completely different. In normal years grasses sprout and grow very rapidly, usually inhibiting the germination or growth of other species. But in 1983, the grass was low, brown, decayed, and covered by thriving forbs, vines, and annual shrubs. This suggests that grasses were the first plants to germinate and grow, but then the humidity of 1983 fatally damaged the grass and gave other plants predominance. I.e., duration of rains and the continuous humidity induced a new successional process. Whether this is the true succession is still to be proved, but the unique structure of the vegetation community in the despoblados of Piura is beyond any doubt.

Piura can be divided into four distinct ecozones differing in vegetation cover and composition. This zonation is a result of variation in annual precipitation -- from 50 mm in the western-most ecozone to 500 mm in the eastern-most (for more details see Pobladores de los despoblados, Chapters 2 and 4).

²Parodi, G. and Zambrano, R. (1967), Evaluacion Forrajera de Pastos Naturales en el Departamento de Piura. Veterinaria y Zootecnia Ano XIX, No. 53.

³Solano Zamora, M. (1977), Rendimiento y Valor Nutritivo de los Pastos Naturales de la Zona de Clmos en Condiciones Naturales y Cultivadas. Tesis, Universidad Nacional "Pedro Ruiz Gallo", Zootecnia, Lambayeque.

The Sechura desert comprises most of ecozone A. This region is usually denuded of any vegetation except for a few low shrubs partly covered by mobile sand. But in July 1983, the Sechura was covered by a carpet of hairy grass known locally as barba de chivo 'buck's beard', a legume known as charanstillo, and a forb called hierba blanca (Alternanthera holimifolia). Succulent leaves and stalks also signaled the location of the tubers yuca de monte and yuca de caballo.

This area today serves as a refuge for many peasants from the lower Piura valley who had to leave their homes because of 1983's floodings. Some of the herders interviewed near the new road from Lambayeque to Piura came from San Cristo village in the lower Piura valley, some 30-40 km from the road. These poor farmers have had to rely more on their small goat herds, which now graze the green vegetation in what is normally one of the most arid deserts in the world. Huge lagoons of running water were created in the low areas of the desert; these help solve livestock watering problems, since the Sechura desert has no permanent sources of water. Some farmer-refugees have also established small vegetable plots in the now-moist desert soil in order to provide some food to their hungry families.

Problems of accessibility prevented me from visiting the despoblados of Sullana (ecozone B). However, some idea of ecozone B changes can be derived from examination of vegetation along the Piura-Chuluicanas road (or more accurately, along the road's former course) since this region is climatologically similar to Sullana. First, trees and shrubs, previously dormant, are now thriving. This is especially true for the Overal shrubs, (Cordia rotundifolia) which were nearly bare during the drought and now are densely covered with healthy

leaves and yellow flowers. The Overall is, quantitatively, the dominant plant in this ecozone and its transition from a dormant to a productive stage makes for a very significant change in the whole region. However, not only the Overall has experienced dramatic alterations. The Algarrobo (Prosopis juliflora), Faique (Acacia macranta), Charan (Caesalpinia corymbosa), and Hualtaco (Laxopteygium huasango) are also covered with new foliage and blooms. Many vines climb up the trees and shrubs and, together with annual (or biannual) shrubs, considerably increase the green vegetation cover of the region. Among the dominant plants in this last group are chirimosco or Verbesina sp., barilla, hierba blanca, alfalfilla, and many others.

Along the western side of the sierra of Piura lies the third ecozone(C). It includes the despoblados of Pabur and the northern part of the department of Lambayeque (the Olmos area). Vegetation changes in this region are quite dramatic, especially on the heavily grazed rangelands of Ganaderia Amazonas and Pabur. Again, the regrowth of Overall has greatly changed the green biomass. Forbs like the legumes barbasciollo and alfalfilla (Stylozanthus grailis or Crotolis sp.), annual shrubs (frijolillo and overillo), and vines (especially coriguela--Merremia sp. and jabonillo--Luffa operculata) also contribute much to the vegetation community, which now covers the ground almost completely. The dead grass (paja, mostly Eragrostis sp.) lies beneath this thick cover of annual forbs and shrubs.

Ecozone D extends east of San Lorenzo and Las Lomas, and it regularly receives a fair amount of precipitation (300-500 mm). The higher humidity and proximity to the vegetative communities of the sierra--dry tropical forest-- permit a dense and diverse flora. As a

consequence of the 1983 rains, the region is completely covered by vegetation of all types in a three-story structure. In some areas, the vegetation is so dense that it is impassable. Camotillo is the dominant vine here; mosquera, overal, and borrachera are the dominant perennial shrubs; and trees and forbs are numerous. Grass is still found in some places and is the most desirable forage.

Monitoring vegetation changes is only the first step in evaluating the new forage potential of the region. Information on the palatability and nutritional value of the new plants is also required. Unfortunately such information is unavailable, and very little is being done to collect it. It is also difficult to estimate how long the vegetation will remain in its green stage; much depends on the coming rainy season (December-April). A very dry year will cause much of the green biomass to dry up, and some will disappear. A regular or wet year will help keep the despoblados green and preserve the high quality pasture. It was hard for the goat herders with whom I talked to evaluate this new resource, too. Many of them admit they have never before seen the despoblado in this condition. All agree, though, that the input to the system is so extensive that forage for their goats is ensured for two or even four more years, regardless of climatic regime.

Poisonous plants present another problem in utilizing the new pasture. Again, knowledge on this subject is scant. Some herders claimed that the very common legume barbaŝco causes abortions, while other ganaderos disagreed. The borrachera and some vines are known to be poisonous; but the degree to which goats consume them now and the extent of the damage to herds is unknown.

Goats

The ability of peasant goat keepers to take advantage of this vast amount of forage is restricted by herd size. Almost none of the goat keepers in Piura are accustomed to buying goats, except for occasional purchases of studs. Herds are ganaderos' only source of cash, so it really doesn't make much sense to sell goats in order to buy other ones. Moreover, even herders who want to buy cannot; nobody is willing to sell productive goats at this abundant time. There is no better expression of this sentiment than the one herders themselves use: "una cabra en produccion cuesta ahora un ojo, 'selling a producing goat now is like losing one eye'.

COMPETITION FOR PASTURE

At present, pasture is so plentiful that competition is not likely, and it even seems a bit out of place to mention it. Nevertheless, two developments could change the picture significantly. The first is government plans to introduce thousands of imported cattle to the region. A massive cattle operation could deplete the resources very rapidly. Proper management is the key to success in such an operation. After the El Nino of 1972 the government founded, together with private investors, the Ganaderia Amazonas -- a huge cattle ranch with thousands of animals imported from Argentina and Central America. The aim was to take advantage of the abundant pasturage. After a promising start, the enterprise began to lose money, mainly because of high stocking rates on poor pastures resulting from several dry years following an abundant year in 1972. By 1982 the operation was officially bankrupt.

Dry years, coming after two or three good seasons during which herds are allowed to increase, can also introduce strong competition for scarce forage. Once Ganaderia Amazonas started to lose livestock and money, they tried to blame the goat herders, accusing them of overgrazing and resource depletion (Pobladores de los Despoblados, Chapter 7). They also tried to exclude the goat herds from the ranch's territory, although this was their traditional grazing area. Only a court decision prevented catastrophe for the herders.

Different interest groups are currently taking steps to ensure future access to pasture in Piura. Among the parties involved are: the peasant community of Catacaos; the agro-livestock cooperatives Alvaro Castillo and Pabur and other cooperatives from Alto Piura; private ranchers, including some residents of other departments; the ex-workers of Ganaderia Amazonas who have been organized in a livestock cooperative; and some semi-organized groups of goat herders, e.g. the grupo San Jose, composed of herders from the Chulucanas region.

The principal issue in these "pasture politics" is the fate of the vast rangelands controlled by the government. By law, all pasturage on non-private land is owned by the government -- which rushed out decrees to collect rent and taxes on these resources. All the interest groups mentioned above obviously wish to obtain exclusive access to as much of this pasture as possible for as low a fee as possible. Yet the government plans to introduce imported cattle on these same rangelands as soon as feasible.

PRODUCTIVITY

The conventional wisdom among many officials and scientists in Peru is that the criollo (native) goat is not very productive. Many suggest genetic improvements and introduction of exotic varieties in order to develop the goat industry in northern Peru. Elsewhere I have argued against these proposals and urged a careful examination of the criollo's, actual performance, especially under extensive management in comparison to other production systems (Pobladores de los Despoblados, Chapter 3). It was also suggested that the seemingly low production record of goats in Piura is largely a result of dry seasons or years, plus poor diet. The potential for high production, however, does exist. Once enough pasture is available (rainy years) or diet is otherwise improved (e.g., through migration to the stubble fields), productivity reaches a very high level. Further the criollo goat should not be considered solely a milk-producer; it is also a kid-producer and a multiple-purpose animal generally. This is the way local herders view their livestock and carryout their selection process. Goats whose litter size is large are left with the herd. Others which kid only once a year are sold even if they produce a lot of milk.

A visit to the despoblados of Piura today will convince even disbelievers of the criollo's high productive capacity. The first wave of rains arrived in mid-December and generated green pasture right at one of the annual kidding peaks. The rich diet helped does reenter estrus quickly. By mid-July of 1983 most does of reproductive age (older than 12 months) had had their second kidding or were in the final stages of pregnancy. Almost every herder with whom we talked claimed that most kiddings in his herd were twins. The criollo goat is locally

famous for having multi-kid litters once sufficient forage is provided. In a regular year, kiddings are confined to certain seasons, probably reflecting the availability of good forage. The kidding pattern during the coming year or two should change because nutritional and physiological states are expected to be adequate all year long.

MORTALITY

High mortality, especially among young kids, is the most annoying problem in the despoblados of Piura today. Herders complained of losses of up to 50% of new-born kids, mostly at a very early age. There was no consensus on the causes for these uncharacteristically high mortality rates, although most herders tended to blame the high humidity. The common symptoms -- fever, weakness, and diarrhea -- may indicate a viral disease, perhaps Septisemia. Since similar complaints were reported by all herders interviewed, in all ecozones, it seems safe to assume that the disease has something to do with the humidity and not with a certain type of forage. Goat keepers also claimed that by June-July the mortality rate was declining, probably because of the gradual drying of the environment. If this claim proves true, it will be of utmost importance for future herd dynamics since June, along with December, is a peak kidding period.

More data should be gathered during the upcoming dry season--July to December--in order to reach a better conclusion on the relationship between humidity and high neonate mortality rates. Veterinarians consulted on the problem could offer only limited insights because they have no firsthand experience with it. They suffer from a constant lack of funds and transportation, and so can not travel to the despoblado to

examine the livestock. Veterinarians are usually consulted at their office by the wealthier or more progressive herders who describe the health ills of their animals; the veterinarian makes a "blind diagnosis" and then prescribes a medicine or recommends a treatment.

Another problem in some herds is sudden blindness among healthy adult goats. This phenomenon -- locally called ojos hondos 'deep eyes' -- is probably a contagious Ophthalmia known to be correlated with a humid environment. Interestingly, many herders in Piura are not very familiar with this disease. They may slaughter afflicted goats or let them graze freely in fields where the animals can fall and hurt themselves -- instead of corralling the goats for a couple of weeks while the self-healing process takes place. The fact that long and very wet seasons are rare in Piura likely contributes to unfamiliarity with this disease.

MANAGEMENT

Goat management in Piura is quite simple. Only very limited resources, energy, and capital are invested in goat production. In some ways, this brand of pastoralism resembles a wildlife system incorporated into a peasant household economy. Yet its results are impressive. Currently, with abundant pasturage and with livestock grazing close to the house, the managerial requirements are even fewer.

However, in Summer 1983, much household effort and time was required for milking, processing cheese, and attending the young kids. This obviously was not the case during the drought of 1982. Almost all these tasks are performed by the women and children of the household. Men mostly cultivate the family's rainfed plot.

Another practice observed at present in Piura is giving salt to adult goats. This, too, is a consequence of the abundant green pasturage which requires salt for complete digestion. Salt is also needed for efficient milk production.

PRIMARY VS. SECONDARY PRODUCTS

Like everywhere else, producers in Piura must make decisions about the production system. Concentrating on milk production dictates certain management techniques and breed selections different from those of meat production. Most goat herders in Piura are primarily meat (kid) producers (Pobladores de los Despoblado, Chapter 4). Limited milk production takes place near the main urban centers. In abundant years when milk is plentiful, herders face the dilemma of whether to let the kids suckle freely and grow rapidly, or to restrict kids' consumption and take advantage of the milk for cheese making. Homemade cheese is a highly marketable product in Piura, where modern dairy processing is relatively undeveloped. The decision becomes more acute when litter size grows; then the herder must carefully calculate kids' needs for milk versus his cheese making enterprise. Most herders in Piura consider kids' growth a first priority. But cheese is produced from any milk surplus. Currently, perhaps because of high mortality among kids, there is enough milk not only to satisfy family dairy requirements but also to market half-dry cheese (quesillo) to the cities.

KID MARKETING STRATEGY

Three options concerning newly produced kids are generally available to a herder: increase family consumption, market more kids (at

the most desirable age) and increase cash income, or save as many kids as possible and build up the herd.

An analysis of slaughterhouse data (1973-1982), combined with personal interviews, revealed a common marketing strategy among Piuran goat herders. They appear to market mainly young buck kids and to minimize sales of productive or potentially productive (young does) goats in good years to the level dictated by household maintenance requirements. This strategy leads to herd build-up, especially in abundant years when kidding may exceed 100%. This strategy seems logical when herd dynamics during dry years are considered. Then, sharp decreases in productivity, higher herd susceptibility to disease, and greater economic pressure compel the sale of productive does; herd size drops accordingly. A herder can lose up to 50% of his herd in a very dry year. The "survival strategy" is then quite obvious: increase herd size while conditions allow it, since sooner or later it will be naturally reduced.

The current situation in Piura supports this conclusion. A very limited number of goats from the despoblados are being marketed on the urban market, but most kids are left with the herd. Also, there is definitely an increase in kids slaughtered for home-consumption; or in ganaderos' words, "this is the time to let my children eat real meat and not just rice with some meat flavor."

The herders' economic necessities today are minimal; their herds provide plenty of milk, cheese, and meat, and the rain-fed agricultural parcels (rozo) yield vegetables -- principally corn, beans, and lentils. The pressure to sell livestock in order to get cash for purchasing food is therefore rather low, and families can easily increase herd size.

Even the male kids, normally first to be sold, are kept with the herd as long as possible to gain maximum weight and thus cash profit. An anecdote illustrates these points. An old woman from a nearby agricultural village was observed in the community of Salas seeking a goat to buy. She intended to slaughter the goat for the anniversary of her mother's death. After a long day of searching, the woman returned home empty-handed and disappointed. Nobody in the community was willing to sell her a single goat!

KID MARKETING

Two additional factors figure in livestock marketing: transportation and product demand. Both factors have changed considerably since the onset of the rains. Usually livestock are sold at home to merchants who cross the despoblados with trucks selling foodstuffs and buying livestock and firewood. The flood destroyed the net of unpaved roads leading to most of the despoblados hamlets. Since these roads are not maintained by the government, it will be months before they are reopened. The impact on marketing is obvious. Indeed, merchants from the principal livestock distribution center in the department (centro de Acopyo) in Sullana, complain they cannot reach some villages previously known to be major livestock suppliers. They also mentioned difficulties in persuading ganaderos in accessible communities to sell.

The same El Nino which bestowed such rich pasturage on the despoblados hit agricultural villages and the cities very hard. Damages are estimated in the millions of dollars, and the economic impact on almost every household is evident. Under such conditions the market

does not flourish. People who suffer economically tend to reduce meat consumption and therefore demand for goat meat -- one of the cheapest meats -- has been low during the rainy period.

Table 3 presents a comparison of 1982 and 1983 slaughtering data from the central slaughterhouse in Piura City. These data reflect shifts in marketing strategy and meat consumption in dry versus wet years.

Table 3

Goats and Kids Slaughtered in Piura
(January to June, 1981-1983)

<u>Month</u>	<u>1983</u>		<u>1982</u>	
	<u>#</u>	<u>Kgs</u>	<u>#</u>	<u>Kgs</u>
January	704	13377	2798	14042
February	720	13831	3008	14321
March	447	9599	3290	14731
April	555	11191	2685	12215
May	645	11944	2575	9441
June	424	7881	2845	12654

Total weight (kids + adults) = 98,588 kgs.
Average weight of a kid = 4.4 kgs.
Average weight of an adult goat = 16.5 kgs.

<u>Month</u>	<u>1983</u>		<u>1982</u>	
	<u>#</u>	<u>Kgs</u>	<u>#</u>	<u>Kgs</u>
January	987	18723	2798	14042
February	715	13277	3008	14321
March	755	13961	3290	14731
April	1073	20828	2685	12215
May	1034	19413	2575	9441
June	738	13616	2845	12654

Total weight (kids + adult goats) = 177,222 kgs.
Average weight of a kid = 4.5 kgs.
Average weight of an adult goat = 18.8 kgs.

From the data in Table 3 it is clear that goat provision (both adults and kids) declined 50% from 1982 to 1983. It is hard to say which of the factors mentioned earlier played a major role in this decline: transportation problems, the unwillingness of producers to sell, or economic crisis leading to diminished meat consumption in the urban centers. It is important to bear in mind that 1982 was a very dry year when herders were forced to sell unusually large numbers of goats. In 1981, a regular year, the amount of goat meat consumed in Piura was 130,069 kgs, a value intermediate between those of extremes years.

DAIRY-PRODUCT MARKETING

The excess of goat milk which herders currently enjoy does not find its way to the market easily. Present transportation problems are particularly acute; but there has always been a lack of transport for fresh milk from the despoblados. Furthermore, the only industrial dairy in the region (near Sullana) does not purchase goat milk. So, any excess of milk is processed into cheese at home. The most popular cheese is quesillo -- a dry-cruste'd white salty cheese which can be stored for a couple of days. If transport is available, much of the cheese is marketed in the cities, where it is in great demand. In other cases, it is consumed at home.

The economic crisis also affects the dairy market. Senor Miranda has a nice herd of criollo-anglo nubian goats -- a primarily milk-producing breed. He manages the herd in such a way that he can market fresh milk every day to Chulucanas. Because he lives near the main road, transport has not been a problem. Since the rainy season, however, senor Miranda has had to take his milk to the larger, far

distant market of Piura, because most of his previous clients can no longer afford milk themselves. The fact that many goat herders live in the vicinity of Chulucanas, and that all have excess milk, makes competition in shrinking, local markets even stiffer.

IMPACT OF GOATS ON VEGETATION

Goats suffer from a "bad image" all over the world, and Piura is no exception. They are accused of destructive browsing habits and of overgrazing the range. I have discussed this issue more thoroughly in Pobladores de los Despoblados, Chapter 8. But it is interesting to examine some of these accusations in light of the present state of rangelands in Piura. Currently, pasturage is of ample quantity and high quality, the latter evidenced by species diversity and high percentages of legumes and forbs. This raises the question of whether the range was really so overgrazed, or whether moisture/precipitation was actually the principal factor limiting range production. If the latter is true, then last year's range was merely drought-stricken, not overgrazed.

Another common indictment of goats in Piura is the destruction, by browsing, of algarrobo tress--the most common tree in the region. Algarrobo actually has some defense mechanisms -- such as the high alkaloid content of its leaves -- which make it fairly resistant to browsing. Furthermore, goats help in the distribution and germination of the algarrobo by eating the tasty and nutritious pods. Algarrobo seeds have to be mechanically scarified in order to germinate; this process takes place when the seeds pass through a goat's digestive track. In consequence, old corrals and the area around herders' huts were covered with thousands of algarrobo seedlings in July 1983.

Between January and June, they had grown to more than two meters. But never were goats observed browsing these seedlings. In many cases, ganaderos had to cut a path through dense groves of young algarrobo in order to reach their houses. So, it seems that in previous years there was not enough moisture in Piura to support massive germination of algarrobo; but once water is provided, the algarrobo population regains its vitality regardless of -- or perhaps even with the help of -- browsing goats.

In short, the El Nino of 1983 has dramatically changed the biological and human ecosystems of Piura. It will take more than a short visit to critically assess its full impact. Nevertheless, some of the principal effects observed during my trip have been noted in this report. Some suggestions for further research and data collection are suggested below.

1. A long-term followup of selected herds in order to monitor productivity, diseases and mortality, and herd dynamics.
2. Immediate initiation of a comprehensive range study in the region. Despite a number of plans for intensive exploitation of range resources, there has been no professional range study conducted in Piura since the 1983 El Nino. An extensive qualitative and quantitative evaluation of pasture resources is critical in planning rational land-use programs.
3. A market study assessing the relative importance of various factors in meat/kid marketing--herd build-up, lack of transportation, and low demand in cities.
4. A socio-economic study of potential milk/cheese marketing and its limiting factors, technical as well as political.
5. A continuous followup of political developments concerning open versus state range and assessment of the role each interest group--government, private entrepreneurs, peasant communities, goat herders, and cooperatives--is playing.